AbstractID: 10171 Title: Optimization of collimator trajectory in volumetric modulated arc therapy: development and evaluation for paraspinal SBRT

Purpose: To develop a collimator trajectory optimization paradigm for volumetric modulated arc therapy (VMAT) and evaluate this technique in paraspinal stereotactic body radiation therapy (SBRT). **Method and Materials:** We propose a novel VMAT paradigm, Coll-VMAT, which integrates collimator rotation into the synchronization of gantry rotation, multileaf collimator (MLC) motion, and dose rate modulation. A principle component analysis (PCA) calculates the primary cord orientation using the cord contour projection on the beam's eye view for each gantry angle, thereafter determining a collimator angle such that MLC travel is parallel to the PCA-derived direction. In this way, cord can be constantly blocked while minimizing resultant blocking of the planning target volume (PTV), and more MLC pairs are available for dose modulation. Standard VMAT optimization follows the geometry-based collimator trajectory calculation, to obtain the optimal MLC position and monitor units (MU) at each gantry angle. Evaluation compares Coll-VMAT-optimized plans to standard VMAT and IMRT in 5 paraspinal SBRT patients. Prescription dose to the PTV is 24Gy while constraining the cord maximum dose to 14Gy. Plan evaluation statistics include PTV V22.8Gy, PTV D95%, cord mean dose, and total beam-on time. **Results:** Collimator rotation in the five Coll-VMAT plans ranges from 26°-54°, with a median of 40°. Patient-averaged PTV V22.8Gy (94.6% with Coll-VMAT vs 92.1% VMAT and 93.3% IMRT) and D95% (22.5Gy vs 21.4Gy and 22Gy) are higher, while cord mean dose is lower (9.8Gy vs 10.0Gy and 11.7Gy). Total beam-on time is comparable to standard VMAT and substantially lower than IMRT (5164MU vs 4868MU and 13,283MU). **Conclusion:** The dosimetric advantage of Coll-VMAT is significant especially for small targets. Collimator trajectory optimization provides an additional degree of freedom in VMAT optimization that can improve dosimetric quality of paraspinal SBRT compared to standard VMAT and IMRT. **Conflict of Interest:** Research agreement with Varian Corporation